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ABSTRACT

An investigation of the naturalistic acquisition of a second language phonology, based on the case of a native Icelandic speaker learning the fricatives and affricates of English, reveals that neither transfer hypothesis nor the developmental hypothesis alone provides an adequate explanation of second language phonological development. This development is best accounted for by a systematic interaction between general processes of phonological development and transfer from the native language. Transfer best predicts the order of difficulty of English fricatives and affricates, while the developmental hypothesis best predicts sound substitution for difficult segments. The pattern of interaction between transfer from the native language and developmental processes noted for fricatives and affricates may be somewhat different for other types of phonological segments. Finally, variability--in language models, among different language learners, and in an individual child's production--is a complicating factor for any detailed analysis of phonological development. Several ways are suggested of taking these types of variability into account in future studies of second language phonological acquisition. (Author/JB)

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LEARNING TO SPEAK WITHOUT AN ACCENT:
ACQUISITION OF A SECOND-LANGUAGE PHONOLOGY*

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Despite ever-increasing interest in parallels between first and second language acquisition, the acquisition of second language phonology has generally been neglected. A common observation has been that children master a second language phonology, that is, learn to speak without an accent, with relative ease and great speed, especially when compared to their adult counterparts. However, little research has specifically examined the nature of this process. In particular, the relative contributions of the child's native phonology and of general processes of first language phonological acquisition deserve to be explored.¹ In other areas of second language acquisition, for example morphology or syntax, comparable issues have been discussed and at least two viewpoints, here presented in extreme versions, have been expressed.

The first position (hereafter, the Developmental Position) is that acquisition of a given language by second language learners closely parallels its acquisition by first language learners. Language transfer is considered a minor factor. As McLaughlin (1978) states: "...there is a unity of process that characterizes all language acquisition, whether first or second language, and...this unity of process reflects the use of similar strategies of language acquisition". [p.206]

The alternate viewpoint (hereafter, the Transfer Position) is that first language knowledge affects the acquisition of a new linguistic system, and many of the difficulties faced and solutions attempted during second language development can be predicted by a contrastive analysis of the two systems.

Focusing more specifically on phonology, the Developmental Position predicts that the order of difficulty of segments, the role of word position, and particular error types will be similar for first and second language learners of any given language. Conversely, the Transfer Position predicts

*An earlier version of this paper was presented at the Fourth Annual Boston University Conference on Language Development, Sept. 14, 1979. Throughout its preparation we benefitted greatly from discussions with Charles Ferguson; Marilyn Vihman, Eve Clark and Lise Menn also made valuable comments on earlier versions. We especially want to add a hearty "Takk" to Steinar and his parents--their patience and cooperation made this study possible.

¹Of course, development of phonology in children raised bilingually has been discussed by investigators such as Leopold (1939-1949), Gregoire (1947), Vogel (1975), and Major (1977).

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that the relative difficulty of phonemes and allophones, the importance of word position for allophonic variation, and any sound substitutions which appear will be traceable to the influence of the first language.

In the present study, we address these issues by first examining in detail the initial stages of one child's development of a portion of English phonology. We provide evidence from L₂ phonology in support of a stance taken by Wode (1976) and by Ferguson and Debose (1977)--that neither the Developmental Position nor the Transfer Position alone leads to a complete explanation of second language acquisition. We discuss the systematic interaction of these two factors, then briefly consider how our findings apply to other parts of the child's phonology. Finally, we raise some methodological questions which demand attention in further research.

The subject, Steinar, is a native speaker of Icelandic, who was just six years old at the time observations began. Based on parental report, his Icelandic pronunciation was completely fluent and his phonological acquisition had proceeded normally. Prior to coming to the Boston area, he had had no exposure to English. His mother had just begun to teach him to read in Icelandic. From the tenth week after his arrival, he was tape-recorded for approximately one hour weekly over a period of eight months in naturalistic interaction with one of the investigators (RM), a native speaker of English with no conversational knowledge of Icelandic. Four weeks after taping began, he entered first grade, but at no point was he given specific language instruction in English. His parents, both Icelanders, spoke English and Icelandic to him. An only child, he had few regular contacts with other Icelandic children or adults during this period.

The portion of Steinar's English phonology which we have chosen to focus on is the fricative and affricate system. There are two reasons for this: 1) There is a substantial literature on children's native acquisition of English fricatives (Ferguson, 1975; Ingram, 1975; Olmsted, 1971; Farwell, 1977; Moskowitz, 1975; and Edwards, 1979). 2) There are clear contrasts between the fricative systems of English and Icelandic. These are summarized in Figure 1.

There are five phonemes of English which are not found at all in Icelandic: /z/, /ʃ/, /ʒ/, /tʃ/, /dʒ/. In addition, the two languages have contrasting allophonic distributions of interdental fricatives. In Icelandic, there is only one interdental, which we will call eth /ð/, whose allophones depend on word position. Initially, it is voiceless as in þak [θakʰ] 'roof'. Medially, it is voiced, as in eða [eða] 'or', while finally it is half-voiced as in bað [bað̥] 'bath' or hvað [kvað̥] 'what'. English, in contrast, has two distinct interdental phonemes, /ð/ and /θ/, whose voicing can be contrasted in all word positions. Compare voiceless thigh and voiced thy, voiceless ether and voiced either, and voiceless teeth and voiced teethe. An Icelander acquiring English must, therefore, learn to distinguish and produce the two phonemes rather than one. Another adjustment that must be made is a more forceful pronunciation of the sound /v/, which is generally "less energetic" (Einarsson, 1945, p.22) in Icelandic than in English. This weaker quality is indicated by the asterisk under the Icelandic [v̥] in Figure 1.

Our corpus for phonological analysis consisted of over 4300 phonetically transcribed fricative and affricate segments. For Sessions 1 through 5 (the

FIGURE I.

Comparison of Icelandic and English fricative and affricate systems

	ICELANDIC (L ₁)			ENGLISH (L ₂)		
	Initial	Medial	Final	Initial	Medial	Final
/f/	[f] faðir 'father'	[f] kaffi 'coffee'	[f] eff 'F'	[f] fat	[f] shuffle	[f] half
/v/	[v] vera 'to be'	[v] hafa 'to have'	[v] nef 'nose'	[v] vat	[v] shovel	[v] have
/s/	[s] sofa 'to sleep'	[s] lesa 'to read'	[s] ís 'ice'	[s] sue	[s] fussy	[s] race
/z/				[z] zoo	[z] fuzzy	[z] raise
/θ/	[θ] þetta 'that'	[ð] eða 'or'	[ð] báð 'bath'	[θ] thigh	[θ] ether	[θ] teeth
/ð/				[ð] thy	[ð] either	[ð] teethe
/ʃ/				[ʃ] shoe	[ʃ] mission	[ʃ] mash
/ʒ/					[ʒ] vision	[ʒ] garage
/tʃ/				[tʃ] chew	[tʃ] lecher	[tʃ] match
/dʒ/				[dʒ] Jew	[dʒ] ledger	[dʒ] Madge

How Icelandic (L₁) and English (L₂) contrast:

- 1) L₁ = L₂:
 - /f/, /s/ all positions
 - /ð/ medially
 - /θ/ initially
- 2) L₂ requires some phonetic/allophonic adjustment:
 - /v/ all positions (must be stronger, more forceful)
 - /ð/ initially (must be voiced)
 - finally (must be more fully voiced)
 - /θ/ medially, finally (must be devoiced)
- 3) L₂ segments not found in L₁:
 - /z/, /ʃ/, /ʒ/, /tʃ/, /dʒ/ all positions

first five recording sessions) we noted all the relevant segments in each of three word positions (initial, medial, and final) and their phonetic environments. By the end of the first five weeks, it was clear that some segments were giving Steinar little difficulty. We therefore eliminated from further detailed analysis any sound that, in a given word position, had at least thirty tokens across the five sessions and was produced correctly at least 85% of the time.² Those eliminated were /s/ and /f/ in all positions and initial /ð/ and /θ/.

As Figure II shows, three sessions beyond Session 5 were analyzed--weeks 6, 10, and 14. We expected to find more significant changes at monthly than at weekly intervals for the sounds Steinar had not yet mastered. By Session 10 it was apparent that /r/, although still relatively rare, was pronounced with very high accuracy in all positions--72/74 tokens correct overall. Of those segments analyzed beyond the tenth week, only medial /ð/ improved enough by the last session to consider it no longer problematic. To summarize Figure II, the easiest sounds for Steinar were /s/ in all positions, /f/ in all positions, initial /θ/, and initial /ð/, followed by /j/ in all positions and then medial /ð/. Still troublesome or very infrequent through week 14 were /z/, /v/, /ʒ/, /tʃ/, and /dʒ/ in all positions, and medial and final /θ/.

Order of Difficulty

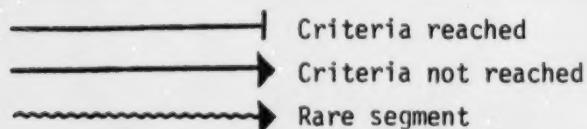
How does Steinar's treatment of these sounds bear on the relative roles of developmental and transfer processes in the development of a non-native phonology? One obvious way to assess this is to examine the order of segment difficulty predicted by each and see which order best fits the data.

Relative difficulty predicted by the Transfer Position is straightforward. Those allophones common to English and Icelandic (see Figure I) should be the easiest. Two other classes of sounds--the completely new segments and those involving some phonetic or allophonic adjustment of Icelandic phonemes--should be more difficult, although there appears to be no a priori reason to order these two classes with respect to each other.

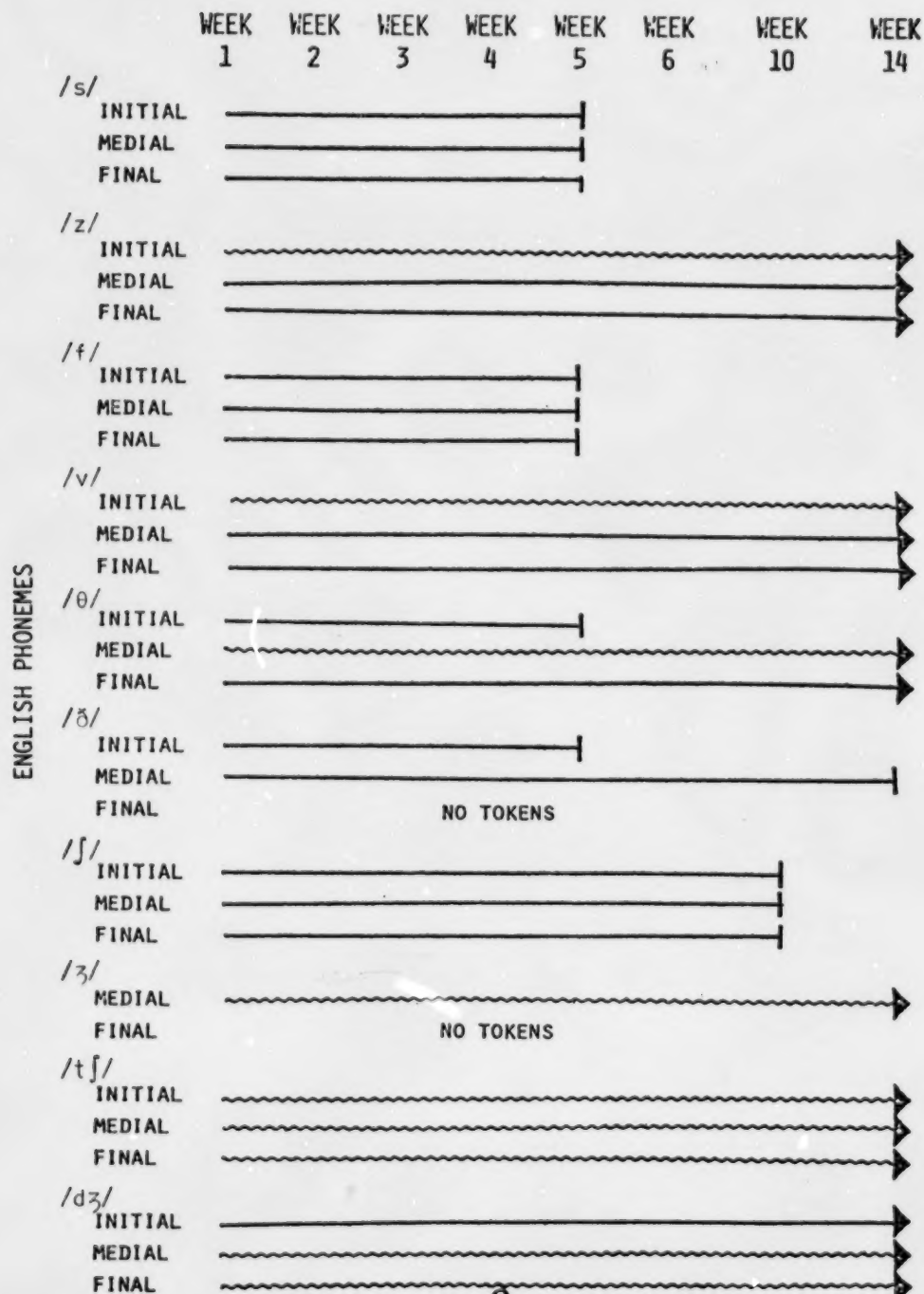
An order of difficulty based on what is known about English L₁ fricative acquisition is harder to specify since existing studies generally emphasize substitution types and variation both within and across individual children. However, Olmsted's 1971 cross-sectional study presents a developmental sequence that has not been contradicted by evidence from more recent studies (as summarized in Ferguson, 1975). Although it does not include the affricates, Olmsted's study does have the particular advantage of taking word position into account. We have collapsed Olmsted's six stages of development into three groups to make them comparable to the three classes of sounds which fall out of the contrastive analysis of English and Icelandic. Figure III

²Due to the variability inherent in language development and use (see discussion, p. 12), 100% correct production would be an unrealistic expectation. Moreover, there is no generally accepted criterion of phonological acquisition. When we examined our data, 85% seemed to be a natural cut-off point since most items were correctly produced in either significantly more or significantly less than 85% of all occurrences.

FIGURE II
LONGITUDINAL COMPARISON OF SEGMENTS STUDIED



Criteria = 1) More than 30 tokens by 5th week
2) 85% correct in average of 5 sessions



compares the fit of our data (omitting the affricates) to these two predicted orders of difficulty for Sessions 1-5.

Figure IIIa attempts to fit the data to the Developmental Position. The three groups of sounds derived from Olmsted's order of acquisition are shown at the top, in predicted order from easiest to hardest. The segments included in each group are shown in parentheses. In no session do the percentages correct for the three groups order as predicted by this hypothesis. The difference between the groups predicted to be easiest and hardest is insignificant and the group which should have been of medium difficulty is significantly more difficult than the other two.

Figure IIIb compares the data with the order predicted by the Transfer Position. The sounds that should be easiest according to this hypothesis, the shared allophones, are shown with a solid line. As can be seen from the top line on the graph, this set of sounds is in fact the easiest for Steinar. He produced them correctly in over 85% of all instances for all sessions. Although we had no clear grounds for predicting an order between new segments and those requiring allophonic adjustments, the new segments were consistently more difficult. The percentage correct for the allophonic modifications is shown with a dotted line on the graph and the dashed line indicates the percentage correct for new segments. The predictions of the Transfer Position are thus supported by Steinar's English pronunciations, while the Developmental Position (as we have interpreted it) does not fit our data.

Sound Substitutions and Phonological Processes

Another way of comparing the two hypotheses is to examine the phonological processes³ that govern segment substitutions in those sounds not correctly pronounced. Figure IV presents the most common processes (collapsing all segment types) by word position as a percentage of the total number of errors per session. Only those processes that accounted for at least five percent (5%) of the total errors in a given session are included. As Figure IV indicates, the most prevalent processes across all sessions were final devoicing

³An inherent problem of any process analysis of phonological development is determining which process or processes apply to produce a given substitute. For example, when Steinar produces [ɔɹændʒʊs] for 'orange juice' (i.e. eliminating one of the /dʒ/ segments), do we count this as deletion of final /dʒ/ in 'orange' or initial /dʒ/ in 'juice' or of some medial /dʒ/ in a single lexical item 'orange juice'? Similarly, what processes are applying when 'put that' comes out as [pʰɔdæt]--voicing of final /t/ and deletion of initial /ð/ or deletion of final /t/ and stopping of initial /ð/? It seems intuitive that some features of two segments (i.e. [+stop] and [+voice]) are being collapsed into one segment, but a process analysis does not easily capture this intuition. Such problems will arise in any attempt to explain acquisition in terms of phonological processes (see, for example, Edwards, 1979, pp. 42-46), but are undoubtedly compounded in our rapid, connected speech data, where the number of word boundary phenomena is greatly increased. We have eliminated problematic word boundary examples from our analysis of processes.

FIGURE III
ORDER OF DIFFICULTY OF SEGMENTS: PREDICTIONS AND DATA

(NOTE THAT AFFRICATES ARE OMITTED)

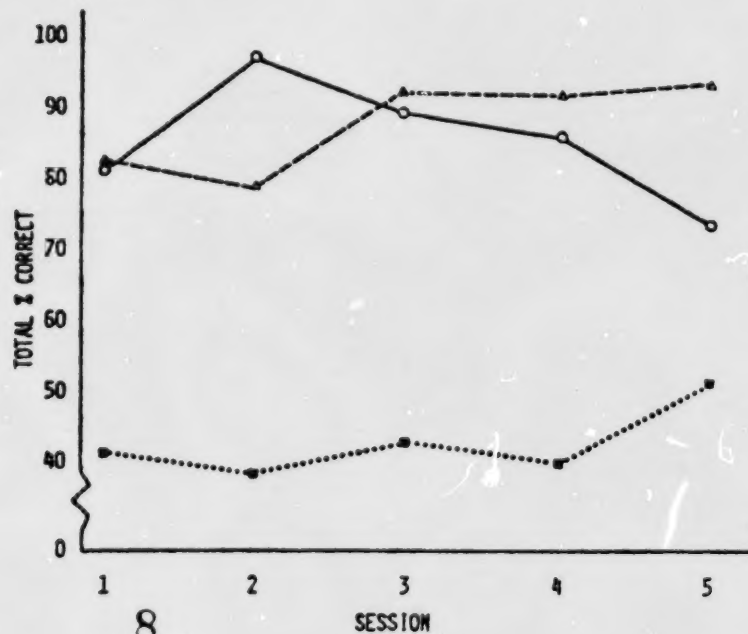
KEY: X- = WORD INITIAL SEGMENT
-X- = WORD MEDIAL SEGMENT
-X = WORD FINAL SEGMENT

IIIa. L₁ DEVELOPMENTAL HYPOTHESIS
(DERIVED FROM OLMSTED, 1971)

PREDICTIONS:

EASIEST ○—○ GROUP 1 (f-, -f-, -f, s-, -s-, -s, -f, -z-)
↑
●.....● GROUP 2 (f-, -z-, -v-, -v-, -θ-, -θ)
HARDEST ▲---▲ GROUP 3 (-f-, z-, v-, θ-, ð-, -ð-, -ð, -ʒ-, -ʒ)

Data:

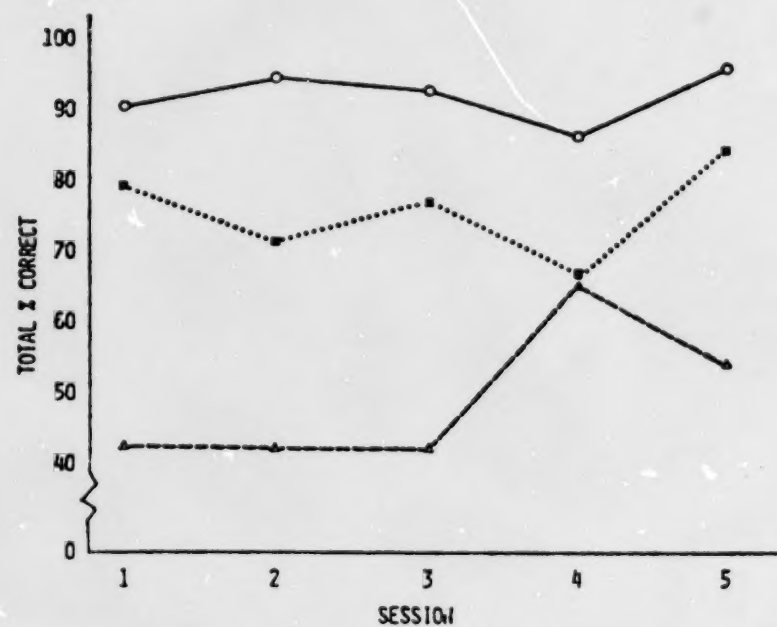


IIIb. TRANSFER HYPOTHESIS

PREDICTIONS:

EASIEST ○—○ L₁ (ICEL) = L₂ (ENG) (s-, -s-, -s, f-, -f-, -f, 0-, ð-)
■.....■ ALLOPHONIC/PHONETIC ADJUSTMENT NEEDED IN L₂ (ENG)
(v-, -v-, -v, ð-, -ð-, -ð)
HARDER ▲---▲ NEW SEGMENTS, FOUND IN L₁ (ENG) BUT NOT L₂ (ICEL)
(z-, -z-, -z, ʒ-, -ʒ-, -ʒ, -ʒ-, -ʒ)

Data:



Processes		Session							
		#1	#2	#3	#4	#5	#6	#10	#14
devoicing	I	7.0	4.8	1.7	--	1.8	--	0.9	--
	M	1.3	0.8	13.3*	--	2.7	1.6	1.7	2.7
	F	40.0	49.6	41.3	50.8	53.0	74.6	65.5	71.0
looser closure	I	1.3	0.8	5.0	3.4	0.9	--	0.9	--
	M	13.0	7.2	4.0	--	2.7	4.8	2.6	2.7
	F	0.6	--	6.6	5.1	7.2	7.9	5.2	8.7
tighter closure	I	9.5	10.4	5.8	10.2	9.0	4.8	6.9	
	M	4.4	2.4	2.2	--	0.9	1.6	0.9	
	F	1.9	0.8	0.4	1.7	5.4	6.3	1.7	
deletion	I	--	--		--				--
	M	0.6	3.2		11.8				0.5
	F	7.6	2.4		--				7.7
palatalization	I	1.3			--				
	M	--			--				
	F	5.1			10.2				
voicing	I		1.6		--			--	
	M		--		--			4.3	
	F		4.8		5.1			2.6	
labialization	I		6.4						
	M		1.6						
	F		--						

*all due to one lexical item

FIGURE IV

Most common phonological processes operating in substitutions for L₂ fricatives, broken down by word position: I (initial), M (medial), F (final). Figures are percentages of total errors per session.

and initial tighter closure. Final looser closure gained prominence in later sessions. These are common processes in L₁ fricative acquisition (Edwards, 1979).

For some segments, the Transfer and Developmental Positions predict that different processes would apply, resulting in different substitutes, while for other segments the predictions are not readily distinguishable. One of the clearest examples of conflicting predictions concerns initial /ð/. In Icelandic, only a voiceless interdental fricative may occur initially (Figure I); according to the Transfer Position, Steinar should substitute this voiceless variant for /ð/ in the early stages of learning English. Conversely, English developmental fricative studies (e.g. Edwards, 1979) show a high proportion of substitutes for initial /ð/ involving tighter closure (e.g. stopping it to [d]) and very few substitutes (3%) of similar fricatives like [θ]. Where Steinar made pronunciation errors of initial /ð/, substitutes of tighter

closure predominated, as predicted by the Developmental Position. Devoicing, especially to [θ], was rare. Overall, however, his production of the initial /ð/ segment was quite good. This might be accounted for in terms of general processes noted in first language development as well. Several investigators (Ferguson, 1975; Ingram, 1975; and Stampe, 1973) have asserted that the voicing of fricatives in initial position is a common first language process. It is one Steinar might be exploiting early on in his production of /ð/.

Another class of sounds for which the two hypotheses make different predictions are the novel affricates and fricatives. Here, the developmental predictions can account for virtually all of Steinar's substitutions in terms of processes common among first language learners, while the transfer predictions, that phonetically similar segments from Icelandic will "fill in" for new English sounds, are only partially adequate. For example, when confronting /dʒ/, Steinar occasionally produced [d], which is an Icelandic phone, as in [dus] for 'juice' (see Figure V). [d] could also arise, however, from application of a common L₁ process, depalatalization, to the target affricate. In the more telling cases, Steinar substituted sounds non-existent in his native language, as [ʒ] for /dʒ/ in [enʒɪn] for 'engine' or [ʃ] for /tʃ/ in [ʃi:s] for 'cheese'. The process of affricate weakening reported by Edwards (1979) for first language learners would account for this type of substitution. The data subsumed under the transfer hypothesis are therefore a subset of those explainable by developmental processes.

FIGURE V
Substitutes for Novel Segments

	Possible Transfer from Icelandic	Possible English L ₁ Process
tʃ → t		
ouch → [awt]	+	+
dʒ → d		
juice → [dus]	+	+
dʒ → ʒ		
engine → [enʒɪn]	-	+
tʃ → ʃ		
cheese → [ʃi:s]	-	+

There are many cases, though, where the two hypotheses make the same prediction. One example is the devoicing of final /z/. In Icelandic, only its voiceless counterpart /s/ is found. According to the Transfer Position, /s/ should appear in place of final /z/, especially since final devoicing is common elsewhere in the Icelandic consonant system. Final devoicing is also prevalent in children acquiring English as a first language, and so would be predicted by the Developmental Position. Steinar did devoice final /z/ frequently, in some 54% of all its occurrences in our data, and showed no difference from the first to the fourteenth week. A third factor which may have contributed to the high rate of devoicing of final /z/ is that it is an acceptable American English pronunciation in some phonetic contexts and

speech styles. To assess the relative importance of these three factors we would need a better picture of the prevalence of final devoicing of /z/ in the English most commonly modelled to Steinar.

Thus far we have presented examples from our data predicted by one or both hypotheses. Our data suggest that transfer from L₁ is the major factor in determining the difficulty of segments, while developmental processes provide a more complete account of the actual substitutions Steinar made. Yet the two factors may not always operate independently in a developing phonology.

If we allow interaction between transfer and developmental processes, we may be able to explain the persistence of some substitutes but not others. We would like to suggest a model in which those substitutes predicted by both transfer and developmental processes are the ones most likely to appear and to persist.⁴ This is, in fact, what we find in the case of final /z/. Devoicing of final /z/ may be a persistent and pervasive process in Steinar's phonology precisely because it has more than one possible source.

Our final example is of a phenomenon that neither transfer nor developmental factors alone would have led us to expect. The transfer hypothesis was an excellent overall predictor of those sounds which Steinar produced most accurately. However, one segment from this set did not fit the pattern, medial /ð/. This segment posed no problem for Steinar in Icelandic. In English it was distorted nearly beyond recognition. This apparent anomaly became less puzzling when we noticed that Steinar had occasion to use medial /ð/ only in the environment directly preceding syllabic /r/, as in 'other' or 'father'. The American retroflexed /r/ was a totally new segment for him and one that challenged all his articulatory skills. In his early attempts to pronounce words with syllabic /r/, the /r/ itself was often produced quite adequately. The preceding /ð/, however, suffered the consequences. Our suspicion that syllabic /r/ was at fault here was confirmed by Steinar's treatment of many other consonants in the same environment. These consonants were not problematic in most positions. But in early occurrences of words like 'water', 'monster', 'eraser', 'sugar', 'hunters', and 'paper', the consonant or cluster before /r/ seldom resembled its target.

This sort of "trade-off" between two presumably distinct elements in the child's developing phonology (i.e. medial /ð/ and syllabic /r/) has also been reported in the literature on first language development (e.g. Ferguson and Farwell, 1975; Garnica and Edwards, 1977). In short, Steinar's difficulty in pronouncing medial /ð/ can be traced to the combined effects of native language interference with syllabic /r/ and subsequent phonological trade-off involving preceding segments.

This analysis of the fricative and affricate data suggests interaction at many levels. We observed behavior predicted by both hypotheses on second language acquisition. The Transfer Position is best supported when we consider

⁴This model, which allows a cumulative effect of various processes, could be expanded to assign appropriate "weightings" to other conservative factors, e.g. cognates. For example, Steinar consistently devoiced medial /z/ in English 'thousand' (Icelandic þúsund [θusʊnth]) while in non-cognates he produced it voiced without difficulty.

the relative difficulty of segments. The Developmental Position is also upheld. It allows the most complete account of the phonological substitutions in Steinar's early attempts to produce fricatives and affricates.

The Role of Transfer in Non-fricative Segments

The pattern of interaction suggested by this study is based only on the data from fricatives and affricates. Although we did not carry out quantitative analyses of other aspects of Steinar's emerging English phonology, it is our impression that interference from Icelandic may prove to be a more important factor in accounting for substitutions for other classes of segments. Consider the following examples of substitute types that might best be accounted for by transfer from Icelandic rather than by L₁ developmental processes:

1) Final oral stop consonants

In the early sessions final stops were typically devoiced and heavily aspirated, as are final stops in Icelandic (Einarsson, 1945, p.23). Although final devoicing is an L₁ developmental process, final aspiration is not a process that has been noted among children learning English as a first language.

Examples:

- a) /g/ became aspirated [k^h] in final position but remained voiced and unaspirated medially, as in 'big' [bɪk^h] versus 'biggest' [bɪgɛst].
- b) /d/ became aspirated [t^h] in final position, as in 'bread' [brɛt^h] or 'and' [ænd^h].
- c) /k/ is aspirated in final position, as in 'like' [laɪk^h].

2) Final velar nasal [ŋ]

A velar stop was frequently inserted after final [ŋ]. This corresponds to a phonotactic rule of Icelandic, where velar nasals may not appear word-finally (see Einarsson, 1945, pp. 18-19). Steinar produced both voiced and voiceless stop intrusions in this position:

'going' [gɔwɪŋk]	'sitting' [sɪtɪŋg]
'coming' [k ^h ʌmɪŋk]	'sleeping' [slɪpɪŋg]

3) Liquids

Substitutes for retroflexed [ɻ] were often apical trills, corresponding to the trilled [r] in Icelandic, as in:

'clarinet' [klarɪnɛt]	'broke' [brɔk ^h]
'nearer' [nɪɛrə]	'room' [rɔm]
'water' [wɔtɹ]	

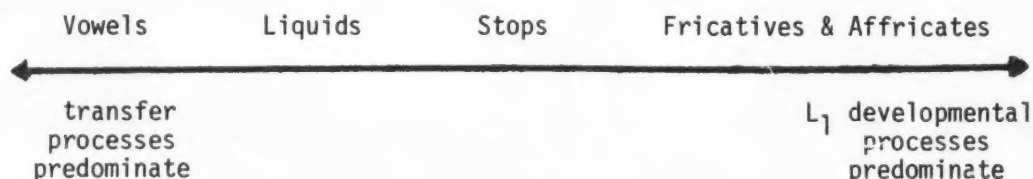
The English velar allophone of /l/ was often produced as a clear apical lateral, the only variety of /l/ in Icelandic:

'small' [smɔl [^]]	'apples' [a [^] pɪl [^] ɪz]
'little' [l [^] ɪtɪl [^]]	'twelve' [twɛl [^] v]

4) Vowels

Overall, vowels retained traces of an Icelandic "accent" longer than other classes of segments, even as long as one year after observations began. English diphthongs were usually rendered as pure vowels and vowels were generally produced slightly higher than their English targets.

We would like to propose that the role of interference in determining substitute types may be more or less evident in different parts of the second language learner's developing phonology. Our data suggest a continuum roughly like this:



More systematic analyses of non-fricative data and of data from a larger number of language-learners will be necessary to substantiate this tentative proposal. The relationship between any two L₁ and L₂ phonologies will presumably affect the ordering of segment classes along this continuum.

Variation as a Methodological Concern

There are three sources of variation in our data which do not affect the major findings of this study, but which should be explored in future studies in order to present a more complete account of the acquisition of an L₂ phonology. They are: variation among English models, individual variation, and variability due to rapid, connected speech.

a) Model Variability

We mentioned variability of the L₂ model in our earlier discussion of devoicing of final /z/, and pointed out that the amount of final devoicing in Steinar's English might partially reflect the particular dialect he was learning. Not only are there no normative data on the amount of final devoicing found in the speech of English-speaking six-year olds, but it is apparent that even if such data existed, they would not necessarily give an accurate picture of the speech actually modelled to Steinar. Certain speech patterns that Steinar developed were not modelled to him in the variety of Standard American English of the adult investigator nor in the accented speech of his parents. Such phenomena as insertion of /r/ at the end of [ɑ]-final words, initial stopping of /ð/, and deletion of /r/ in certain environments were observed in later sessions. For example, 'idea' [aydiɑ], 'there' [dɛɹ], 'these' [diz], 'carefully' [k'æfəli], and 'car' [k'hɑ:] are all typical Boston pronunciations he could have heard from school friends. Peer speech clearly needs to be described so as to assess its possible influence on Steinar's pronunciations. In addition, his other main sources of English (e.g. his school teacher, adult "playmates", and parents) should be documented. The more completely the range of variability can be described in each of the L₂ models Steinar hears, the better we can evaluate the potential influence of modelled forms on the variability of his own speech patterns.

b) Individual Variation

Any direct attempt to compare the development of English phonology in first and second language learners is complicated by the extensive individual variation described within and among children learning the phonology of their first language. Edwards (1979), for example, has shown that her subjects acquiring English as a native language varied both in the order in which they acquired different fricative and affricate segments and in the extent to which they relied on different phonological processes in their productions. She does not find an invariant course of development common to all the children she studied, although she does suggest some general tendencies supported by data from the subjects as a group. A further characteristic of first language development--the variability inherent in any one child's phonological productions (see, for example, Ferguson and Farwell, 1975; Scollon, 1976; Menn, 1979)--must also be kept in mind when trying to compare L_1 and L_2 development. Some of the variability observed in the speech of a child learning a second language may well result from the same forces that produce variable pronunciations during the course of first language development, e.g. spontaneous production versus imitation, conflicting or changing phonological rules, and the influence of particular lexical items. The role of such forces has yet to be assessed in L_2 production.

c) Rate of speech

Rapid, connected speech is an additional source of variability in our data which makes it difficult to compare Steinar's English phonological development directly with that of young first language learners. His acquisition of English syntax proceeded at an impressive pace, so that by the third session (twelfth week of exposure to English) he often produced utterances in excess of twelve words. His connected speech in spontaneous conversations contrasts sharply with the carefully elicited single-word utterances that have comprised that data for most first language phonology studies. As Steinar's facility with English grammar improved, he also spoke more and more rapidly. This resulted in what looked like no improvement or worse productions of some segments. "Mistakes" due to lack of knowledge about English phonology in Steinar's early speech may have given way to "mistakes" resulting from rapid speech phenomena common among fluent English speakers. Although Steinar in fact became a more competent English producer, a simple error analysis might not give that impression. As a supplement to naturalistic speech data, eliciting one-word utterances from second language learners would allow better comparability of L_1 and L_2 studies, with the further benefit that more tokens for segments occurring rarely in the child's spontaneous speech can be collected.

Conclusion

This investigation of the naturalistic acquisition of a second language phonology has revealed the following:

- 1) Neither the Transfer Position nor the Developmental Position alone provides an adequate explanation of L_2 phonological development.
- 2) This development is best accounted for by a systematic interaction between general processes of phonological development and transfer from L_1 . Transfer best predicts the order of difficulty of English fricatives and affricates, while the developmental hypothesis best predicts sound

substitutions for difficult segments.

- 3) The pattern of interaction between transfer from L₁ and developmental processes that we noted for fricatives and affricates may be somewhat different for other types of phonological segments.
- 4) Finally, variability--in language models, among different language learners, and in an individual child's production--is a complicating factor for any detailed analysis of phonological development. We suggest several ways of taking these types of variability into account in future studies of L₂ phonological acquisition.

Learning to speak without an accent may look like child's play, but, in fact, it is a complex process which we are just beginning to understand.

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